

REPLACEMENT CLAIMS

Cancel claims 11 and 20.

1. (Amended) A method for forming a semiconductor device comprising:
providing a semiconductor substrate;
forming a metal oxide layer over the semiconductor substrate;
forming a patterned gate electrode over a first portion of the metal oxide layer; and
removing a second portion of the metal oxide layer by heating the semiconductor substrate
and flowing a halide-containing species over the substrate while heating, wherein the
second portion of the metal oxide layer is adjacent to the first portion of the metal
oxide layer;
wherein removing a second portion of the metal oxide layer is performed in a reaction
chamber in the absence of rf activation.
2. (Amended) The method of claim 1, wherein the halide-containing species further comprises
hydrogen.
3. (Amended) The method of claim 2, wherein the halide-containing species is HCl.
4. The method of claim 1, wherein the metal oxide layer is hafnium oxide.
5. (Amended) The method of claim 1, further comprising:
forming an patterned ARC layer over the patterned gate electrode prior to the flowing of
the halide-containing species; and
removing the patterned ARC layer after the flowing of the halide-containing species.
6. (Amended) The method of claim 5, further comprising:
forming a first interfacial oxide layer under the metal oxide layer;
removing at least a portion of the first interfacial oxide after removing the second portion
of the metal oxide layer.

7. (Amended) The method of claim 6, wherein removing at least a portion of the first interfacial oxide layer is performed using a species containing hydrogen and fluorine.

8. The method of claim 7, further comprising forming a second interfacial oxide over the semiconductor substrate.

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CONT. 9. The method of claim 1, wherein the step of removing is further characterized as being at a temperature of between about 625 degrees Celsius to 675 degrees Celsius.

10. (Amended) The method of claim 9, wherein the step of removing is further characterized as being at a pressure of about 50 torr for approximately 60 seconds and a flow rate of the halide-containing species at about one SLM.

11. 12. The method of claim 1, wherein heating is performed using a radiation source.

12. 13. (Amended) A method of removing a metal oxide layer that is over a semiconductor substrate, comprising:

placing the semiconductor substrate into a reaction chamber;
heating the metal oxide layer;
flowing, in the absence of rf activation, a chlorine-containing species while heating,
wherein the chlorine-containing species reacts with a portion of the metal oxide layer
to create a byproduct, wherein the byproduct comprises an element from the metal
oxide layer; and
removing the byproduct from the reaction chamber.

13. 14. (Amended) A method for forming a semiconductor device comprising:
providing a semiconductor substrate;
forming a metal oxide layer over the semiconductor substrate comprising hafnium and
oxygen;
removing a portion of the metal oxide layer by heating the semiconductor substrate using
radiation and flowing a species containing hydrogen and chlorine;

wherein removing a second portion of the metal oxide layer is performed in a reaction chamber in the absence of RF activation.

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14-15. The method of claim ¹⁴, wherein heating the semiconductor substrate is at a temperature between about 625 degrees Celsius to 675 degrees Celsius.

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15-16. The method of claim ¹⁴, wherein the semiconductor substrate comprises silicon.

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A² CONT.
17. The method of claim ¹⁶, further comprising:
forming a first interfacial oxide layer under the metal oxide layer;
removing at least a portion of the first interfacial oxide after removing the portion of the metal oxide layer;

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17-18. (Amended) The method of claim ¹⁷, wherein removing at least a portion of the first interfacial oxide layer is performed using a species containing hydrogen and fluorine.

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18-19. The method of claim ¹⁸, further comprising forming a second interfacial oxide over the semiconductor substrate.

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21. (Amended) A method of forming a metal oxide comprising:
providing a semiconductor substrate;
forming a metal oxide layer over the semiconductor substrate; and
removing a portion of the metal oxide layer by heating the semiconductor substrate and flowing a gaseous halide;
wherein removing a portion of the metal oxide layer is performed in a reaction chamber in the absence of RF activation.

20-22. The method of claim ²¹, wherein the gaseous halide comprises hydrogen.

21-23. The method of claim ²², wherein the gaseous halide is HCl.

22-24. The method of claim ²², wherein the gaseous halide is HF.

23-25. The method of claim ²¹, wherein the metal oxide contains hafnium and oxygen.

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24 26. The method of claim ²¹, wherein heating the semiconductor substrate is at a temperature between about 625 degrees Celsius to 675 degrees Celsius.

²⁵ 27. A method of selectively removing a metal oxide layer from a semiconductor substrate, wherein the metal oxide layer has an exposed portion and a portion under a gate electrode comprising the step of flowing gaseous HCl, in the absence of rf activation, over the substrate with the substrate heated to between 600 and 800 degrees Celsius.

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COMT. 26 28. The method of claim ²⁷, wherein the substrate is heated to between 625 and 675 degrees Celsius.

27 29. The method of claim ²⁸, wherein the metal oxide is hafnium oxide.

28 30. The method of claim ²⁹, wherein the substrate is heated by radiation.

29 31. The method of claim ³⁰, wherein the metal oxide overlies an oxide layer.